



# VSEP Vibrating Membrane Separation System for Desalination

Dr. J. Brad Culkin, CTO, New Logic Research, Inc.

# Presentation Outline

- History of Salinity Problem
- Why Spiral-Wound Membranes Can't Recover More Water
- Alternative Approach by NLR with VSEP
- Brine Disposal Options
- The Bottom Line

# History of the Salinity Problem

- Currently about ½ human contribution, and ½ natural processes, e.g. San Joaquin River, etc.
- Currently not deemed economically feasible to remove salt from municipal outfalls and industrial effluent.
  - Traditional membrane systems cannot recover more than 60-70% of the total flow
  - Deep Well injection of remaining fraction
  - Huge injected volumes represent unacceptable loss of water
  - Deep Wells potentially problematic
    - Geology must cooperate
    - High flows especially difficult

## Why can't spiral-wound membranes recover more water?

- Limit of spiral-wound membrane technology is the limiting solubility of TDS
- Precipitation must not occur inside modules
- Extend recovery up to 70% by manipulating precipitation kinetics (antiscalants work this way)
- Few ways to alter thermodynamic equilibrium
  - Adjust pH for calcium salts
  - Eventual limit due to silica
  - Also Fe, Mn, Mg

## Alternative Approach by NLR with VSEP

- VSEP (Vibratory Shear Enhanced Process)
- Open channel flow
- Very high shear rates
- Solids appear by precipitation during reverse osmosis
- Suspended solids slurry causes no problems



## Alternative Approach by NLR with VSEP

- New recovery limit is 95–99%; corresponds to brine concentrations up to 20-30% TDS
- Limit set by osmotic pressure
- Volume reduction of 50:1 or 98% recovery typical
- Cost typically less than \$2.00/1000 gallons
- Disposal of ~20% brine remains a problem



## Disposal Options for Brine

- Deep Well Injection
  - Low flow rates of brine reject
  - Basically pure NaCl
  - Typical cost of \$4.00/1,000 gallons where feasible

## Disposal Options for Brine

- Evaporation
  - High cost / 1,000 gallons: ~\$20-\$50/1,000 gallons
  - Low flows make this potentially feasible
  - NaCl product could be recycled into economy
  - Recovery of phosphate also attractive option



## Disposal Options for Brine

- Land Fill Option
  - Polymer encapsulation emerging technology
  - Work with regulators for extractable limits for NaCl
  - Not currently attractive or ready for prime time

## Disposal Options for Brine

- Haul Brine to a More Logical Outfall Location
  - EBMUD will accept brines for \$0.03/gallon
  - EBMUD outfall is more tolerant of salinity due to tidal action and flushing of the Bay with ocean water

## The Bottom Line

- Through VSEP, it is now possible to deal with the salinity problem by a process solution
- Total cost of treatment as low as \$1.50-\$2.00/1,000 gallons
- Technology is mature, proven, and cost-effective

## The Bottom Line

- Permeate meets all environmental criteria including conductivity and TDS
- Blending near zero TDS permeate with can actually benefit a saline river





VSEP<sup>®</sup>  
INDUSTRIAL STRENGTH  
MEMBRANE FILTRATION



For more information, please contact:

Dr. J. Brad Culkin  
CTO, New Logic Research, Inc.  
510-655-7305 ext. 230  
[bculkin@vsep.com](mailto:bculkin@vsep.com)

Visit the VSEP Web site at <http://www.vsep.com>